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(56) Documents cited

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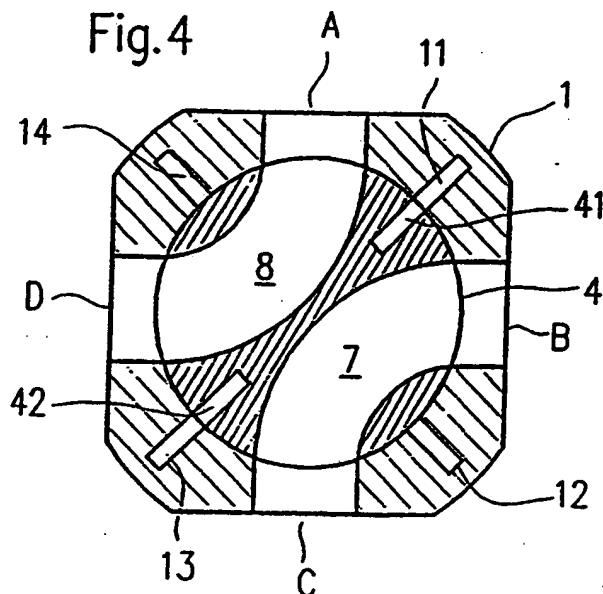
(58) Field of search

UK CL (Edition K) H1W WTS

INT CL⁵ H01P

(54) Waveguide switch

(57) A waveguide switch, comprising a housing (1) and a rotor (4) rotatable therein with channels (7, 8) for optionally linking the housing connections (A to D), provides good crosstalk attenuation even without an extremely narrow gap between the rotor and the inner wall of the housing, if the inner wall regions of the cylindrical bore of the housing (1), located between the connections, are interrupted by at least one axial slit each (11 to 14), if the peripheral areas of the rotor (4), located between the adjacent mouths of different channels (7, 8), are also interrupted by at least one axial slit each (41, 42), and if the depth of the slits is dimensioned so that they form bent $\lambda/2$ chokes in conjunction with the gaps along the periphery of the rotor.



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Fig.1

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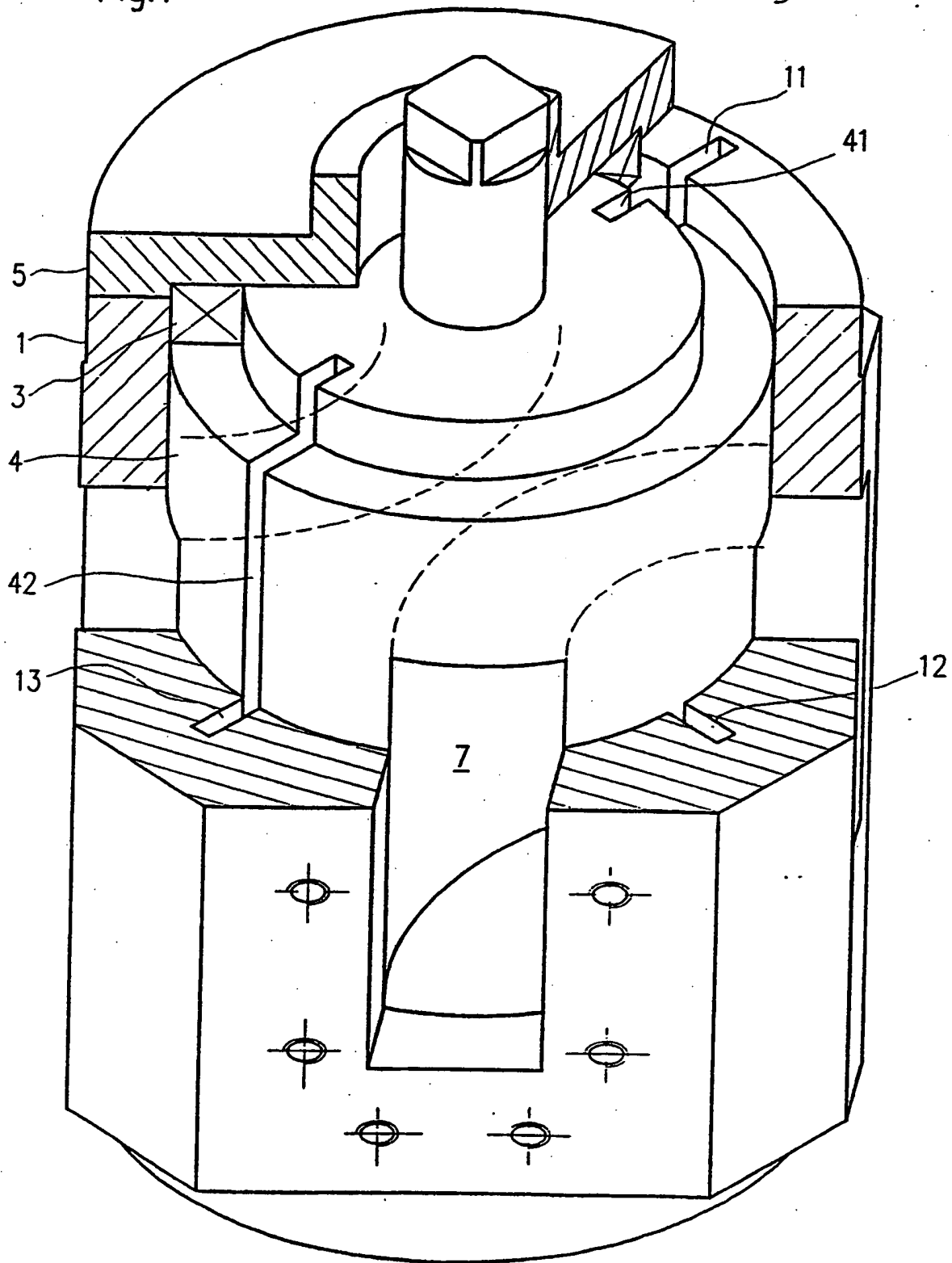


Fig.2

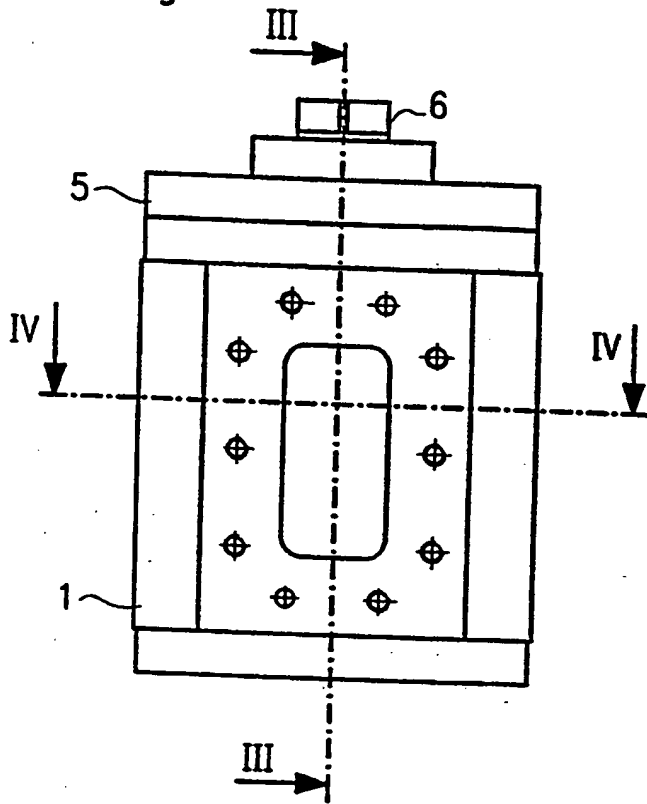


Fig.3

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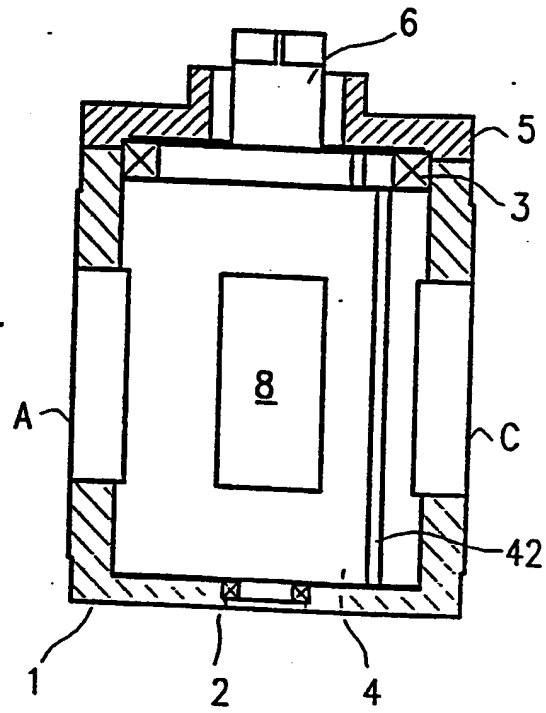
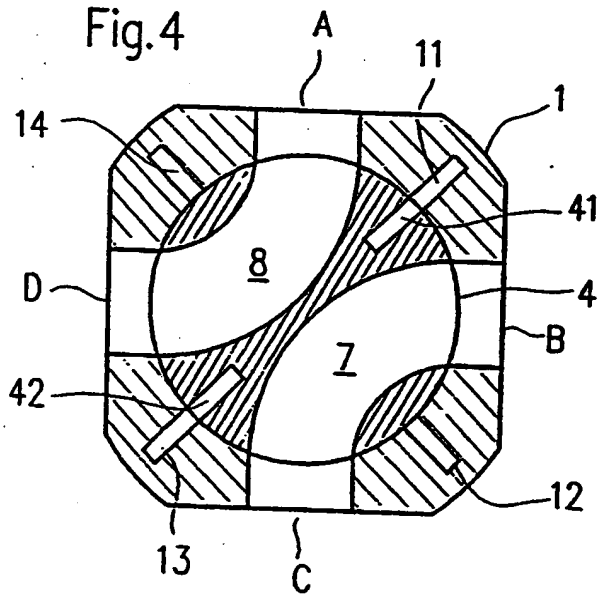


Fig.4



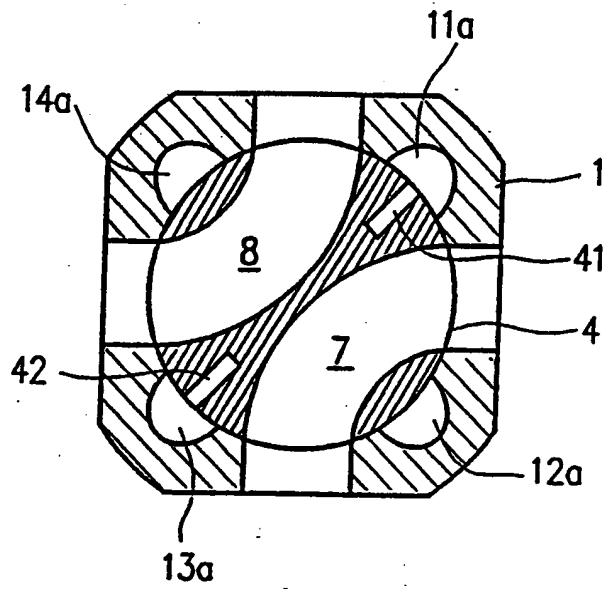


Fig.5

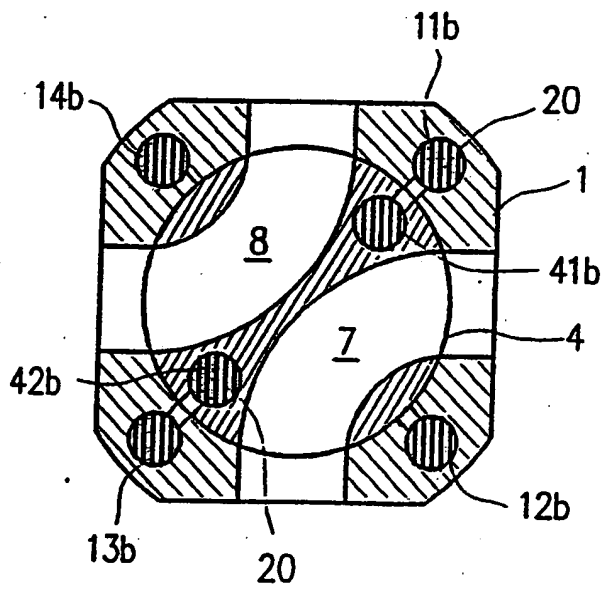


Fig.6

A Waveguide Switch

The invention relates to a waveguide switch, in particular but not exclusively of the type including a housing including a plurality of terminals or ports or connections, and a rotor rotatably arranged in a bore in the housing, the rotor having formed therein a plurality of channels by means of which combinations of said terminals or ports or connections are electrically linkable according to the position of the rotor, and the rotor having an axial slit in the peripheral areas located between the adjacent mouths of respective channels, the slits being such that they form bent $\lambda/2$ chokes in conjunction with the gap between the inner wall of the bore of the housing and the corresponding peripheral areas of the rotor.

Waveguide switches of this type are known, for example, from Swiss patent no. 308 704. The manufacture of such switches calls for component tolerances which can only be obtained by manufacturing with extreme precision in order to attenuate crosstalk between non-adjacent channels. For example, the gap between the peripheral surface of the rotor and the inner wall of the housing must be no larger than 0.01 to 0.02 mm. Waveguide switches made with such small tolerances are not only expensive; they also create problems in both installation and practical operation. Even comparatively slight distortions, which may occur when the switch is screwed onto the trains of the waveguides to be operated and/or which result from heat expansion, make the rotor tight in the housing or cause it to jam.

According to the invention there is provided a waveguide switch, comprising a housing including a plurality of terminals or ports or connections, and a rotor rotatably arranged in a bore in the housing, the rotor having formed therein a plurality of channels by means of which combinations of said terminals or ports or connections are electrically linkable according to the position of the rotor, the rotor having an axial slit in the peripheral areas located between the adjacent mouths of respective channels, and the slits being such that they form bent $\lambda/2$ chokes in conjunction with the gap between the inner wall of the bore of the housing and the corresponding peripheral areas of the rotor, wherein the inner wall regions of the bore in the housing, located between the connections,

are interrupted centrally by at least one axial slit each, the slits being dimensioned to obtain additional $\lambda/2$ chokes similar to those of the slits in the peripheral areas of the rotor.

This solution has the advantage that the waveguide switch can be manufactured with greater tolerances than hitherto and is therefore more cost effective. In addition, the aforementioned difficulties with the installation and operation of the switch will not be experienced.

Thus, there is provided a waveguide switch which has a considerably larger gap between the peripheral surface of the rotor and the inner wall of the housing, yet offers values for crosstalk attenuation between non-linked connections which are at least equal to, if not better than, those of known waveguide switches with small tolerances.

$\lambda/2$ chokes, even in bent form, and the short circuit transformation which they produce, are indeed known per se in high frequency technology. But this proposal is based on the realisation that only a combination of at least two of the $\lambda/2$ chokes in each case, one located in the rotor and the other in the opposing part of the wall of the housing between two adjacent connections, will ensure high frequency crosstalk attenuation values, in spite of the fact that the gap between the rotor and the surrounding wall of the housing is comparatively wide or broad in a mechanical sense.

Preferably, the terminals or ports or connections are adapted to receive rectangular waveguides. The rotor is preferably rotatable in steps about an axis perpendicular to the plane containing the longitudinal axes of the waveguides.

Preferably the axial slits are broader than the slits in the rotor, and are approximately semi-circular in cross-section. This has the advantage that the depth of the slits in the inner wall of the housing can be kept smaller than that of the slits in the rotor. This is an advantage for reasons of the mechanical strength of the housing. Although the breadth of the slits in the rotor could be enlarged with a corresponding reduction in their

depth, there is not normally any reason to do this, since the depth of the slits is considerably less than half the rotor diameter, and adequate wall thickness to the adjacent channels is also left.

Preferably the axial slits have an undercut profile. This embodiment relates largely to production technology: instead of comparatively narrow, deep slits being cut in the inner wall of the cylindrical bore of the housing, axial or longitudinal bores may be provided at the appropriate place in that wall, and may open towards the inner wall of the housing through shallow slits. If required, the slits in the rotor may be formed in the same way.

Preferably, at least part of the cross-section at least of the axial slits is filled with a capacitative, dielectric or lossy material. This embodiment provides a further improvement of crosstalk attenuation. If the slits have the approximately semi-circular profile, the dielectric or capacitative lossy material may be inserted in the particular slits, or in the cylindrical part of them, particularly in the form of a cylindrical rod.

The housing may preferably have four connections arranged in opposing pairs, and the rotor has two quarter circular channels in mirror image and is rotatable in 90° steps.

This is the most frequently used embodiment of the waveguide switch of the invention. Here the rotor is provided with two opposing axial slits, each in the centre of the peripheral regions located between the mouths of different channels.

There now follows a description of a preferred embodiment of the invention, by way of example, with reference being made to the accompanying drawings, in which:

Fig. 1 is a perspective, part cross-sectional elevation of a waveguide switch according to the invention;

Fig. 2 is a side elevation;

- Fig. 3 is a section taken along the line III-III in Fig. 2;
- Fig. 4 is a section taken along line IV-IV in Fig. 2;
- Fig. 5 is a section corresponding to Fig. 4 through a different embodiment; and
- Fig. 6 is a section corresponding to Fig. 4 through a third embodiment.

The waveguide switch illustrated in Figs. 1 to 4 comprises a housing 1 with a hollow cylindrical bore, in which a rotor 4 is rotatably mounted by means of bearings 2 and 3. The housing 1 is closed by a cover 5, which has a central opening for the passage of a pin 6 integral with the rotor 4. The pin is acted on by a drive (not shown), by means of which the rotor can be turned, in 90° steps in this example.

The example is designed for rectangular waveguides, although this proposal is independent of the particular cross-section of the waveguide. The housing 1 has four terminals, or ports or connections A, B, C, D (see Fig. 4 in particular). Figs. 1 and 2 show an elevation and plan view in the direction of the linking flange corresponding to terminal, port or connection C. According to its rotary position, the rotor 4 either links terminals, ports or connections A and B at one side and B and C at the other, or links terminals, ports or connections A and D at one side and B and C at the other. For this purpose the rotor 4 has two channels 7 and 8 in mirror image, their cross-sections corresponding to that of the waveguide to be connected.

Crosstalk between non-linked channels, in the case of Fig. 4 e.g. from channel A-D to channel B-C, is caused primarily by the inevitable gaps between the rotor and the housing, here again chiefly by the gap between the generated and peripheral surface of the rotor 4 and the inner wall of the cylindrical bore of the housing 1. In the past, efforts have been made to keep the gap as small as would be justified by considerations of manufacture, installation and operation. But, as already stated, this confers limitations on the apparatus. The apparatus of the invention, however, goes against the prior art view that the gap must be kept small. The rotor 4 is fitted into the housing 1 with a relatively large peripheral

gap of e.g. 0.05 to 0.1 mm, and the hitherto undesirable property of partial gaps between adjacent connections, of propagating electric fields, is exploited to carry out a transformation, as described below. For this purpose the inner wall regions, of which there are four in the embodiment shown, of the cylindrical bore of the housing 1 are interrupted exactly in the centre of each region by at least one axial slit, i.e. by slits 11 to 14 in the example. The peripheral areas of the rotor, located between adjacent mouths of different channels, are also interrupted by at least one axial slit each, i.e. by slits 41 and 42 in the example. The depth of slits 11 to 14 and that of slits 41 and 42 is such that they produce $\frac{1}{2}$ chokes in conjunction with the lengths of the gap between the inner wall of the cylindrical bore of the housing and the corresponding peripheral surface areas of the rotor, measured from the relevant axial slit to the next joint between the mouth of a channel of the rotor and the associated terminal, port or connection of the housing. In this way the short circuit formed by the bottom of the particular slit is transformed into the peripheral plane as an open circuit, and transformed back into a short circuit by the adjoining gap. In other words, the short circuit region extends from the bottom of a first one of the slits to the top of the slit, along the periphery of the bore as an open circuit and thence across the gap formed at the mouth of one of the channels 7, 8. This short circuit bridges the mechanical gap or joint between the particular housing connection and the mouth of the associated channel of the rotor. It follows that the slits in the housing and rotor which are effective at any given time must be opposite one another. It also follows that, instead of having one slit in the housing and one in the rotor, two parallel, axial slits may be provided in the various regions of the inner wall and peripheral surface.

The slits need not necessarily have the same cross section. An appropriate example is shown in cross section in Fig. 3. Here the housing contains four slits 11a to 14a, each with an approximately semi-circular profile. The enlarged breadth of the slits allows their depth to be reduced, with the same electrical effect. This embodiment is advantageous when the housing has thin walls. The slits in the rotor may have the same cross-sectional profile if necessary (not shown).

An undercut profile may be selected for the slits in both the housing and the rotor. An appropriate embodiment is shown in Fig. 6 in which bores 11b to 14b are formed in the housing and corresponding bores 41b and 42b are formed in the rotor in the two regions between the channels 7, 8. The slits are advantageously formed by extending the bore towards the peripheral surface of the rotor in each case, as shown. The bores extend axially or longitudinally.

A further improvement in crosstalk attenuation can be obtained by filling the slits with a dielectric or capacitative or lossy material, preferably an imperfect dielectric. Although the dielectric 20, represented by hatching, is only indicated here for the Fig. 6 example, this measure can be applied to slits of all forms. In the cross-section through the slits shown in Fig. 6 though, there is the additional advantage that the dielectric 20 can be inserted and securely fixed in the cylindrical part of the slits 11b and 14b and 41b and 42b, in the form of corresponding cylindrical rods.

CLAIMS

1. A waveguide switch, comprising a housing including a plurality of terminals or ports or connections, and a rotor rotatably arranged in a bore in the housing, the rotor having formed therein a plurality of channels by means of which combinations of said terminals or ports or connections are electrically linkable according to the position of the rotor, the rotor having an axial slit in the peripheral areas located between the adjacent mouths of respective channels, and the slits being such that they form bent $\lambda/2$ chokes in conjunction with the gap between the inner wall of the bore of the housing and the corresponding peripheral areas of the rotor, wherein the inner wall regions of the bore in the housing, located between the connections, are interrupted centrally by at least one axial slit each, the slits being dimensioned to obtain additional $\lambda/2$ chokes similar to those of the slits in the peripheral area of the rotor.
2. A waveguide switch according to Claim 1, wherein the terminals or ports or connections are adapted to receive rectangular waveguides.
3. A waveguide switch according to Claim 1 or Claim 2, wherein the rotor is rotatable in steps about an axis perpendicular to the plane containing the longitudinal axes of the waveguides.
4. A switch according to any preceding claim, wherein at least the axial slits are broader than the slits in the rotor, and are approximately semi-circular in cross-section.
5. A switch according to any of Claims 1 to 3, wherein at least the axial slits have an undercut profile.
6. A switch according to any preceding claim, wherein at least part of the cross-section at least of the axial slits is filled with a capacitative, dielectric or lossy material.
7. A switch according to Claim 6, wherein the capacitative,

dielectric or lossy material is an imperfect dielectric.

8. A switch according to any preceding claim, wherein the housing has four connections arranged in opposing pairs, and the rotor has two quarter-circular channels in mirror image and is rotatable in 90° steps.

9. A switch generally as herein described, with reference to or as illustrated in the accompanying drawings.

10. Any novel combination or sub-combination disclosed and/or illustrated herein.

Patents Act 1977
Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

9122346.1

Relevant Technical fields

(i) UK Cl (Edition K) H1W(WTS)

(ii) Int Cl (Edition 5) SELECTED US SPEC IN IPC
SUB-CLASS H01P

Search Examiner

MISS J E EVANS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

4 FEBRUARY 1992

Documents considered relevant following a search in respect of claims 1-8

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
A	GB 846660 (SPERRY) whole document	1 at least
A	GB 753524 (GEC) whole document	1 at least
X	GB 718865 (AIRTRON) whole document	1 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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